IN THE CLAIMS

Please cancel Claims 5, 15, 21-30, 35, 45, 51-60, 65, 75 and 81-105 and Amend the remaining Claims in accordance with the following mark-up copy:

1. (Currently Amended) A wireless communication device, comprising:

a first synthesizer for generating a first radio frequency (RF) signal, the first RF signal including a sequence of carriers;

a transmitter for transmitting the first RF signal;

a receiver for receiving a second RF signal from a remote wireless device phase locked with the first wireless device, the second RF signal including a sequence of carriers corresponding to the carriers of the first RF signal, wherein the frequencies of the corresponding sequence of carriers of the first RF signal are different from the frequencies of the sequence of carriers of the second RF signal;

a second synthesizer for generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the first and second RF signals, wherein the phase of the third RF signal is coherent with the phase <u>of the</u> first RF signal, and wherein the frequencies of the sequence of carriers of the second RF signals are the same as the frequencies of the sequence of carriers of the third RF signal;

a phase detector for comparing the phase of each of the carriers of the second RF signal to the phase of each of the corresponding carriers of the third RF signal and generating a sequence of phase offsets; and

a processor for determining distance between the wireless

communication device and the remote wireless device by calculating an estimated slope of the sequence of phase offsets relative to the frequencies of the sequence of carriers of the second RF signal, wherein the phase detector generates the phase offsets by producing In-phase (I) and Quadrature (Q) signals by mixing the received second RF signal with the third RF signal, and wherein the processor solves for phase angle θ by applying the following relationship: θ = Arctan(Q/I)/2.

2. (Original) The wireless communication device according to claim 1, wherein the sequence of carriers produced by the synthesizer are modulated with a modulation signal, and wherein the phase of the modulation signal is coherent with each of the phases of the sequence of carriers of the first RF signal.

3. (Currently Amended) The wireless communication device according to claim 2, wherein the wireless communication device further comprises:

a local oscillator for generating a reference signal used to synchronize the first and second synthesizers[[,]]; and

a frequency divider for dividing the reference signal to generate the modulation signal.

4. (Currently Amended) The wireless communication device according to claim 1, wherein the phase detector comprises:

a first mixer for mixing the sequence of carriers of the third RF signal with the corresponding sequence of carriers of the received second RF signal, wherein the first mixer outputs a sequence of DC in-phase

components I[[,]];

a phase shifter for shifting the phase of the sequence of carriers of the third RF signal by 90 degrees[[,]]; and

a second mixer for mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal, wherein the second mixer outputs a sequence of DC quadrature-phase signals Q, wherein the I and Q components are used to calculate the phase offsets of each of the sequence of carriers of the second RF signal, and wherein the phase offsets are used to calculate the distance between the wireless communication device and the remote wireless device.

5. Canceled.

6. (Currently Amended) The wireless communication device according to claim [[5]] 1, wherein the processor calculates the slope by executing a phase ambiguity algorithm to produce a relative phase offset Φ among the carrier frequencies of the received second RE signal such that

$$\Phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1) + \pi \text{ if } \theta_n - \theta_{n-1} < 0$$

$$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1) \text{ otherwise}$$

where θ_n is the phase offset for each carrier of the received second RF signals.

7. (Original) The wireless communication device of claim 6, wherein the following relationships are used by the processor to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T: m/2\pi$, where m is the slope of the relative phase shift (Φ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

8. (Original) The wireless communication device of claim 1, wherein the wireless communication device transmits information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

9. (Original) The wireless communication device of claim 1, wherein the wireless communication device and the remote wireless device transfer data to each other to complete a commercial transaction.

10. (Original) The wireless communication device of claim 1, wherein the wireless communication device determines its location based on the calculated distance from the remote wireless device.

11. (Currently Amended) A wireless communication device, comprising:

a first synthesizer for generating a first radio frequency (RF) signal, the first RF signal including a single carrier having a frequency ft0;

a transmitter for transmitting the first RF signal;

a receiver for receiving a second RF signal from a remote wireless

device phase locked with the first wireless device, the second RF signal including a sequence of carriers, wherein the frequencies of the sequence of carriers of the second RF signal are different from ft0;

a second synthesizer for generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the second RF signal, wherein the phase of the third RF signal is coherent with the phase of the first RF signal, and wherein the frequencies of the sequence of carriers of the second RF signal are the same as the frequencies of the sequence of carriers of the third RF signal;

a phase detector for comparing the phase of each of the carriers of the second RF signal to the phase of each of the carriers of the third RF signal to generate a corresponding sequence of phase offsets; and

a processor for determining distance between the wireless communication device and the remote wireless device by calculating an estimated slope of the sequence of phase offsets relative to the frequencies of the sequence of carriers of the second RF signal, wherein the phase detector generates the phase offsets by producing In-phase (I) and Quadrature (Q) signals by mixing the received second RF signal with the third RF signal, and wherein the processor solves for phase angle θ by applying the following relationship: θ = Arctan(Q/I)/2.

12. (Original) The wireless communication device according to claim 11, wherein the sequence of carriers produced by the synthesizer are modulated with a modulation signal.

13. (Currently Amended) The wireless communication device according to claim 2, wherein the wireless communication device further comprises:

a local oscillator for generating a reference signal used to synchronize the first and second synthesizers[[,]]; and

a frequency divider for dividing the reference signal to generate the modulation signal.

14. (Currently Amended) The wireless communication device according to claim 1, wherein the phase detector comprises:

a first mixer for mixing the sequence of carriers of the third RF signal with the corresponding sequence of carriers of the received second RF signal, wherein the first mixer outputs a sequence of DC in-phase components I[[,]];

a phase shifter for shifting the phase of the sequence of carriers of the third RE signal by 90 degrees[[,]]; and

a second mixer for mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal, wherein the second mixer outputs a sequence of DC quadrature-phase signals Q, wherein the I and Q components are used to calculate the phase offsets of each of the sequence of carriers of the frequency-converted second RF signal, and wherein the phase offsets are used to calculate the distance between the wireless communication device and the remote wireless device.

15. Canceled.

16. (Currently Amended) The wireless communication device according to claim [[15]] <u>11</u>, wherein the processor calculates the slope by executing a phase ambiguity algorithm to produce a relative phase offset Φ among the carrier frequencies of the received second RE signal such that

$$\Phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1) + \pi \text{ if } \theta_n - \theta_{n-1} < 0$$

$$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1) \text{ otherwise}$$

where θ_n is the phase offset for each carrier of the received second RF signals.

17. (Original) The wireless communication device of claim 16, wherein the following relationships are used by the processor to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T: m/2\pi$, where m is the slope of the relative phase shift (Φ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

18. (Original) The wireless communication device of claim 11, wherein the wireless communication device transmits information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

19. (Original) The wireless communication device of claim 11, wherein the wireless communication device and the remote wireless device transfer data to each other to complete a commercial transaction.

20. (Original) The wireless communication device of claim 11, wherein the wireless communication device determines its location based on the calculated distance from the remote wireless device.

Claims 21-30 have been canceled.

31. (Currently Amended) A computer readable medium containing program instructions for controlling a wireless communication device and for determining distance between the wireless communication device and a remote wireless device, comprising instructions for:

generating a first radio frequency (RF) signal, the first RF signal including a sequence of carriers;

transmitting the first RF signal;

receiving a second RF signal from a remote wireless device phase locked with the wireless communication device, the second RF signal including a sequence of carriers corresponding to the carriers of the first RF signal, wherein the frequencies of the sequence of carriers of the first RF signal are different from the frequencies of the sequence of carriers of the second RF signal;

generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the first and second RF signals, wherein the phase of the third RF signal is coherent with the phase first RF signal, and wherein the frequencies of the sequence of carriers of the second RF signal are the same as the frequencies of the sequence of carriers of the third RF signal;

comparing the phase of each of the carriers of the second RF signal to the phase of each of the corresponding carriers of the third RF signal to generate a sequence of phase offsets; ~~and~~

calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal, wherein the estimated slope is proportional to the distance between the wireless communication device and the remote device;

mixing the received second RF signal with the third RF signal to produce In-phase (I) and Quadrature (Q) signals;

solving for phase angle Θ by applying the following relationship: Θ = Arctan(Q/I)/2; and

calculating the phase offset based on phase angle Θ.

32. (Original) The computer readable medium of claim 31, further comprising instructions for modulating the sequence of carriers produced by the first synthesizer of the wireless communication device with a modulation signal, wherein the phase of the modulation signal is coherent with each of the phases of the sequence of carriers of the first RE signal.

33. (Currently Amended) The computer readable medium of claim 32, further comprising instructions for:

generating a reference signal used to synchronize the first and second synthesizers[[,]]; and

dividing the reference signal to generate the modulation signal.

34. (Currently Amended) The computer readable medium of claim 31, further comprising instructions for:

mixing the sequence of carriers of the third RF signal with the sequence of corresponding carriers of the received second RF signal to generate a sequence of DC in-phase components I[[,]];

shifting the phase of the sequence of carriers of the third RF signal by 90 degrees[[,]]; and

mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal to generate a sequence of DC quadrature-phase signals Q[[,]];

calculating the phase offsets of each of the carriers of the second RF signal using the I and Q components[[,]]; and

calculating the distance between the wireless communication device and the remote wireless device using the phase offsets.

35. Canceled.

36. (Currently Amended) The computer readable medium of claim 31[[35]], further comprising instructions for calculating the slope by executing a phase ambiguity algorithm to produce a relative phase offset among the carrier frequencies of the received second RF signal such that

$$\Phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1) + \pi \text{ if } \theta_n - \theta_{n-1} < 0$$

$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1)$ otherwise

where θ_n is the phase offset for each carrier of the received second RF signals.

37. (Original) The computer readable medium of claim 36, wherein the instructions use the following relationships to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T: m/2\pi$, where m is the slope of the relative phase shift (Φ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

38. (Original) The computer readable medium of claim 31, further comprising instructions transmitting information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

39. (Original) The computer readable medium of claim 31, further comprising instructions transferring data between the wireless communication device and the remote wireless device to complete a commercial transaction based on the distance between the wireless communication device and the remote wireless device.

40. (Original) The computer readable medium of claim 31, further comprising instructions for determining the location of the wireless communication device based on the calculated distance from the remote wireless device.

41. (Currently Amended) A computer readable medium containing program instructions for controlling a wireless communication device and for determining distance between the wireless communication device and a remote wireless device, comprising instructions for:

generating a first radio frequency (RF) signal, the first RF signal including a single carrier having a frequency ft0;

transmitting the first RF signal;

receiving a second RF signal from a remote wireless device phase locked with the wireless communication device, the second RF signal including a sequence of carriers, wherein the frequencies of the ~~corresponding~~ sequence of carriers of the second are different from ft0;

generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the second RF signal, wherein the phase of the third RF signal is coherent with the phase of the first RF signal, and wherein the frequencies of the corresponding sequence of carriers of the second RF signal are the same as the frequencies of the corresponding sequence of carriers of the third RF signal;

comparing the phase of each of the carriers of the second RF signal to the phase of each of the corresponding carriers of the third RF signal to generate a sequence of phase offsets; ~~and~~

calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal, wherein the estimated slope is proportional to the distance between the wireless communication device and the remote device;

mixing the received second RF signal with the third RF signal to

produce In-phase (I) and Quadrature (Q) signals;

solving for phase angle θ by applying the following relationship: θ = Arctan(Q/I)/2; and

calculating the phase offset based on phase angle θ.

42. (Original) The computer readable medium of claim 41, further comprising instructions for modulating the sequence of carriers produced by the first synthesizer of the wireless communication device with a modulation signal, wherein the phase of the modulation signal is coherent with each of the phases of the sequence of carriers of the first RE signal.

43. (Currently Amended) The computer readable medium of claim 42, further comprising instructions for:

generating a reference signal used to synchronize the first and second synthesizers[[,]]; and

dividing the reference signal to generate the modulation signal.

44. (Currently Amended) The computer readable medium of claim 41, further comprising instructions for:

mixing the sequence of carriers of the third RF signal with the sequence of corresponding carriers of the received second RF signal to generate a sequence of DC in-phase components I[[,]];

shifting the phase of the sequence of carriers of the third RF signal by 90 degrees[[,]]; and

mixing the sequence of 90 degree phase-shifted carriers with the

corresponding sequence of carriers of the received second RF signal to generate a sequence of DC quadrature-phase signals Q[[,]];

calculating the phase offsets of each of the carriers of the second RF signal using the I and Q components[[,]]; and

calculating the distance between the wireless communication device and the remote wireless device using the phase offsets.

45. Canceled.

46. (Original) The computer readable medium of claim 41, further comprising instructions for calculating the slope by executing a phase ambiguity algorithm to produce a relative phase offset among the carrier frequencies of the received second RF signal such that

$$\Phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1) + \pi \text{ if } \theta_n - \theta_{n-1} < 0$$

$$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1) \text{ otherwise}$$

where θ_n is the phase offset for each carrier of the received second RF signals.

47. (Original) The computer readable medium of claim 36, wherein the instructions use the following relationships to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T: m/2\pi$, where m is the slope of the relative phase shift (Φ) v. frequency line and D is the distance between

the wireless communication device and the remote wireless device.

48. (Original) The computer readable medium of claim 31, further comprising instructions for transmitting information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

49. (Original) The computer readable medium of claim 31, further comprising instructions for transferring data between the wireless communication device and the remote wireless device to complete a commercial transaction based on the calculated distance.

50. (Original) The computer readable medium of claim 41, further comprising instructions for determining the location of the wireless communication device based on its calculated distance from the remote wireless device.

Claims 51-60 have been canceled.

61. (Currently Amended) A method of determining distance between a wireless communication device and a remote wireless device, the method comprising the steps of:

generating a first radio frequency (RF) signal, the first RF signal including a sequence of carriers;

transmitting the first RF signal;

receiving a second RF signal from a remote wireless device phase

locked with the wireless communication device, the second RF signal including a sequence of carriers corresponding to the carriers of the first RF signal, wherein the frequencies of the sequence of carriers of the first RF signal are different from the frequencies of the sequence of carriers of the second RF signal;

generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the first and second RF signals, wherein the phase of the third RF signal is coherent with the phase first RF signal, and wherein the frequencies of the sequence of carriers of the second RF signal are the same as the frequencies of the sequence of carriers of the third RF signal;

comparing the phase of each of the carriers of the second RF signal to the phase of each of the corresponding carriers of the third RF signal to generate a sequence of phase offsets; ~~and~~

calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal, wherein the estimated slope is proportional to the distance between the wireless communication device and the remote device;

mixing the received second RF signal with the third RF signal to produce In-phase (I) and Quadrature (Q) signals;

solving for phase angle θ by applying the following relationship: θ = Arctan(Q/I)/2; and

calculating the phase offset based on phase angle θ.

62. (Original) The method of Claim 61, further comprising the step of modulating the sequence of carriers produced by the first synthesizer of

the wireless communication device with a modulation signal, wherein the phase of the modulation signal is coherent with each of the phases of the sequence of carriers of the first RF signal.

63. (Currently Amended) The method of Claim 61, further comprising the steps of:

generating a reference signal used to synchronize the first and second synthesizers[[,]]; and

dividing the reference signal to generate the modulation signal.

64. (Currently Amended) The method of Claim 61, further comprising the steps of:

mixing the sequence of carriers of the third RF signal with the sequence of corresponding carriers of the received second RF signal to generate a sequence of DC in-phase components I[[,]];

shifting the phase of the sequence of carriers of the third RF signal by 90 degrees[[,]]; and

mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal to generate a sequence of DC quadrature-phase signals Q[[,]];

calculating the phase offsets of each of the carriers of the second RF signal using the I and Q components[[,]]; and

calculating the distance between the wireless communication device and the remote wireless device using the phase offsets.

65. Canceled.

66. (Currently Amended) The method of Claim 61[[65]], further comprising the step of calculating the slope by executing a phase ambiguity algorithm to produce a relative phase offset

among the carrier frequencies of the received second RF signal such that

$$\Phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1) + \pi \text{ if } \theta_n - \theta_{n-1} < 0$$

$$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1) \text{ otherwise}$$

where θ_n is the phase offset for each carrier of the received second RF signals.

67. (Original) The method of Claim 66, wherein the following relationships are used to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T: m/2\pi$, where m is the slope of the relative phase shift (Φ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

68. (Original) The method of Claim 61, further comprising the step of transmitting information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

69. (Currently Amended) The method of Claim 61, further comprising the

step of transferring data between the wireless communication device and the remote wireless device to complete a commercial transaction based on the distance between the wireless communication device and the remote wireless device.

70. (Curently Amended) The method of Claim 61, further comprising the step determining[[es]] the location of the wireless communication device based on the calculated distance from the remote wireless device.

71. (Currently Amended) A method of determining distance between a wireless communication device and a remote wireless device, the method comprising the steps of:

generating a first radio frequency (RF) signal, the first RF signal including a single carrier having a frequency ft0;

transmitting the first RF signal;

receiving a second RF signal from a remote wireless device phase locked with the wireless communication device, the second RF signal including a sequence of carriers, wherein the frequencies of the ~~corresponding~~ sequence of carriers of the second are different from ft0;

generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the second RF signal, wherein the phase of the third RF signal is coherent with the phase of the first RF signal, and wherein the frequencies of the corresponding sequence of carriers of the second RF signal are the same as the frequencies of the corresponding sequence of carriers of the third RF signal;

comparing the phase of each of the carriers of the second RF signal to the phase of each of the corresponding carriers of the third RF signal to generate a sequence of phase offsets; ~~and~~

calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal, wherein the estimated slope is proportional to the distance between the wireless communication device and the remote device;

mixing the received second RF signal with the third RF signal to produce In-phase (I) and Quadrature (Q) signals;

solving for phase angle θ by applying the following relationship: θ = Arctan(Q/I)/2; and

calculating the phase offset based on phase angle θ.

72. (Original) The method of claim 71, further comprising the step of modulating the sequence of carriers produced by the synthesizer with a modulation signal.

73. (Currently Amended) The method of claim 72, further comprising the steps of:

generating a reference signal used to synchronize the synthesizer[[,]]; and dividing the reference signal to generate the modulation signal.

74. (Currently Amended) The method of Claim 61, further comprising the steps of:

mixing the sequence of carriers of the third RF signal with the

corresponding sequence of carriers of the received second RF signal to generate a sequence of DC in-phase components I[[,]];

shifting the phase of the sequence of carriers of the third RF signal by 90 degrees[[,]]; and

mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal to generate a sequence of DC quadrature-phase signals Q[[,]];

calculating the phase offsets of each of the carriers of the second RF signal using the I and Q components[[,]]; and

calculating the distance between the wireless communication device and the remote wireless device using the phase offsets.

75. Canceled.

76. (Currently Amended) The method of Claim 71[[75]], further comprising the step of calculating the slope by executing a phase ambiguity algorithm to produce a relative phase offset among the carrier frequencies of the received second RF signal such that

$$\Phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1) + \pi \text{ if } \theta_n - \theta_{n-1} < 0$$

$$\Phi(n) := (\theta_n - \theta_{n-1}) + \Phi(n-1) \text{ otherwise}$$

where θ_n is the phase offset for each carrier of the received second RF signals.

77. (Original) The method of Claim 76, wherein the following relationships are used to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T: m/2\pi$, where m is the slope of the relative phase shift (Φ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

78. (Original) The method of Claim 71, further comprising the step of transmitting information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

79. (Currently Amended) The method of Claim 71, further comprising the step[[s]] of transferring data between the wireless communication device and the remote wireless device to complete a commercial transaction based on the distance between the wireless communication device and the remote wireless device.

80. (Original) The method of Claim 71, further comprising the step determining the location of the wireless communication device based on the calculated distance from the remote wireless device.

Claims 81-105 have been canceled.